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I. *A Letter of Mr. Joseph Williamson Watchmaker, to the Publisher, wherein he asserts his Right to the curious and useful Invention of making Clocks to keep Time with the Suns Apparent Motion.*

HAVING been inform'd of a *French Book* lately published, wherein the Author speaks of making Clocks to agree with the Sun's apparent Motion; and supposeth that it was a thing never thought of by any before himself: I was therefore willing by the advice of some of my Friends, to write this short Account of what I have performed in that matter my self.

And in the first place I must take notice of the Copy of a Letter in this Book, wrote by one *P. Kresa a Jesuit*, to one *Mr Williamson*, Clockmaker to his *Imperial Majesty*; of a Clock found in the late King *Charles the Second of Spain's* Cabinet, about the Year 1699 or 1700. which sheweth both equal and apparent Time according to the Tables of Equation; and which went 400 Days without winding up. This I am well satisfied is a Clock of my own making; for about six Years before that time, I made one for *Mr. Daniel Quare*, for whom I then wrought mostly, which agrees with the Description he gives of it, and went 400 Days as he saith. This Clock *Mr. Daniel Quare* sold, soon after it was made, to go to the said King *Charles the Second of Spain*: and it was made so that if the *Pendulum* was adjusted to the Sun's mean Motion, the Hands would shew Equal Time on two fixed Circles, on one the Hour, and on the other the Minute. But there were other two moveable Circles of the same kind, that
moved

moved forwards and backwards, as the time of the Year required; on which the same Hands shewed Apparent Time likewise, according to the Equation Tables. This Method the Author owns he knew of, and applyed the same Motion to Pocket Watches 12. or 14 Years ago, which I confels I never did; being well satisfied that Watches with Springs and Ballances are very unfit to shew the minute difference, as it increaseth and decreaseth, between equal and apparent Time.

Soon after this Clock was sent to *Spain*, I made others for Mr. *Quare* which shewed Apparent Time by lengthning and shortning the *Pendulum*, in lifting it up and letting it down again, by a Rowler somewhat in the form of an *Ellipsis*, through a slit in a piece of Brass, which the Spring at the Top of the Pendulum went through. By this means every vibration of the *Pendulum* would agree to a Second of Time of the Suns apparent Motion; that Rowler which lifted up the *Pendulum*, and let it down again, being continually moving about all the Year; so that it may seem very strange that this Author never heard of it, so many Years after they were made: For one of those, and not the first, made with the rising and setting of the Sun, Mr. *Quare* sold to the late King *William*, and it was set up at *Hampton-Court* in his Life time, where it hath been ever since. This contrivance of lengthning and shortning the *Pendulum*, I thought of several Years before I made any of them. Since then I have made others for Mr. *Quare* likewise, which shewed the difference between equal and apparent Time according to the Equation Tables, by a Hand moving both ways from the top of a Circle; on one side shewing how much a Clock keeping equal Time ought to be faster than the Sun, on the other side how much slower.

But these Clocks that I then made to agree with the Sun's Apparent Time, were done according to the Equation Tables, which I found not to agree very exactly with the Sun's apparent Motion: neither can any other be made to keep equal Time that will gain and lose all the Year agreeable to the said Tables: for though the Tables themselves may be true, yet some difference in Motion does proceed, in both sorts of Clocks, from Cold and Heat altering the length of their *Pendulums*. This difference by some Observations I have made, I suppose to be about the $\frac{1}{100}$ part of an Inch in the length of a *Pendulum* vibrating Seconds, which will alter the Motion of the Clock about 12 Seconds in 24 Hours. But to make my Clocks made for keeping Apparent Time to go as exact as possible, I made a Table my self by Observation: For observing the Sun, as often as it was to be seen, when it came on the Meridian, for several Years together, always setting down the Difference between its coming to the Meridian and the Time by a Clock I had adjusted as well as I could to equal Time, and always taking notice how much my Equal-Time Clock gain'd or lost at the end of every Year, I compleated my Table in the Year 1711. Since then I have made a considerable many of these Clocks, several of which I sold to Persons of great Note and Ingenuity; and in particular one I made about five or six Years since for the Right Honourable the Lord *Parker*, at present Lord High Chancellor of *Great Britain*; and all of them have given good content to those that bought them. So that I think I may justly claim the greatest right to this contrivance of making Clocks to go with Apparent Time; and I have never yet heard of any such Clock sold in *England*, but what was of my own making, though I have made of them so long.